CLAIMS

[C001] 1. A power controller for an AC load comprising:

a user interface adapted to interact with a user to produce at least one user interface signal; and

a control module adapted to electrically couple a line voltage supply, electrically couple said AC load, and provide electrical power to said AC load as a function of said at least one user interface signal by implementing a low-flicker, cycle-skipping control algorithm, said control algorithm comprising a plurality of cycle patterns, said cycle patterns comprising a plurality of main power levels.

[C002] 2. The power controller of claim 1 further comprising an auxiliary interface adapted to interact with at least one auxiliary sensor to provide at least one auxiliary interface signal to said control module.

[C003] 3. The power controller of claim 1 wherein said control module is adapted to electrically couple exactly one AC load and provide electrical power to said exactly one AC load.

[C004] 4. The power controller of claim 1 wherein said low-flicker, cycle-skipping control algorithm comprises a fine resolution control algorithm.

[C005] 5. The power controller of claim 1 wherein each of said cycle patterns has no net DC component.

[C006] 6. The power controller of claim 1 wherein said main power levels are spaced substantially evenly.

[C007] 7. The power controller of claim 1 wherein said user interface comprises:

a control knob;

an input shaft adapted to mechanically couple said control knob and provide a mechanical signal; and

a shaft encoder adapted to generate said user interface signal in response to said mechanical signal.

[C008] 8. The power controller of claim 1 wherein said user interface comprises:

a touch panel adapted to interact with said user and provide at least one touch signal; and

a communications interface adapted to receive said at least one touch signal and generate said at least one user interface signal.

[C009] 9. The power controller of claim 1 wherein said control module comprises a power supply adapted to electrically couple said line voltage supply and provide signal-level operating power to said power controller.

[C010] 10. The power controller of claim 1 wherein said control module comprises a transient voltage protection module adapted to limit said line voltage supply to a specified safe voltage level.

[C011] 11. The power controller of claim 1 wherein said control module comprises at least one electrical switch adapted to make or break electrical contact with said line voltage supply in response to said user interface signal.

[C012] 12. The power controller of claim 1 wherein said control module comprises at least one line voltage supply connector adapted to electrically couple said line voltage supply.

[C013] 13. The power controller of claim 1 wherein said control module comprises at least one load connector adapted to electrically couple said AC load.

[C014] 14. The power controller of claim 1 wherein said control module comprises:

exactly one load connector adapted to electrically couple said AC load; and

exactly two line voltage supply connectors adapted to electrically couple said line voltage supply.

[C015] 15. The power controller of claim 1 wherein said control module comprises:

exactly one load connector adapted to electrically couple said AC load;

exactly one line voltage supply connector adapted to electrically couple said line voltage supply;

a transformer having a primary winding electrically coupled in series with said line voltage supply and said AC load; and

a dual input power supply adapted to electrically couple said line voltage supply, electrically couple a secondary winding of said transformer, and provide signal-level operating power to said power controller.

[C016] 16. The power controller of claim 1 wherein said control module comprises:

a threshold-crossing detector adapted to generate a threshold-crossing signal whenever an output voltage of said line voltage supply crosses a specified voltage threshold;

a control processor adapted to receive said at least one user interface signal and said threshold-crossing signal and generate a switch command signal by implementing said low-flicker, cycle-skipping control algorithm; and

a power module adapted to receive said switch command signal and provide electrical power to said AC load.

[C017] 17. The power controller of claim 16 wherein said control processor further comprises:

a signal decoder adapted to receive said user interface signal and generate a power command;

a command compensator adapted to receive said power command and generate a power reference signal; and

a switch command generator adapted to receive said power reference signal and said threshold-crossing signal and generate said switch command signal by implementing said low-flicker, cycle-skipping control algorithm.

[C018] 18. The power controller of claim 17 wherein said command compensator comprises a dynamic compensator.

[C019] 19. The power controller of claim 16 wherein said power module further comprises:

a switch driver adapted to receive said switch command signal and generate a gate signal; and

a controllable switch electrically coupled to said line voltage supply and said AC load and adapted to provide electrical power to said AC load as a function of said gate signal.

[C020] 20. The power controller of claim 19 wherein said controllable switch comprises a triac.

[C021] 21. The power controller of claim 19 wherein said power module further comprises a snubber electrically coupled to said controllable switch.

[C022] 22. The power controller of claim 19 wherein said power module further comprises a heat sink thermally coupled to said controllable switch.

[C023] 23. The power controller of claim 22 wherein said power module further comprises a fan adapted to provide an airflow over said heat sink.

[C024] 24. A power controller for use as a direct replacement for an electric range electromechanical heater controller, said power controller comprising:

an input shaft adapted to mechanically couple a control knob and provide a mechanical signal;

a shaft encoder adapted to generate a user interface signal in response to said mechanical signal;

a control module adapted to electrically couple a line voltage supply, electrically couple exactly one cooking element, and provide electrical power to said cooking element as a function of said user interface signal by implementing a low-flicker, cycle-skipping control algorithm, said control algorithm comprising a plurality of cycle patterns, said cycle patterns comprising a plurality of main power levels.

[C025] 25. The power controller of claim 24 wherein said control module comprises a power supply adapted to electrically couple said line voltage supply and provide signal-level operating power to said power controller.

[C026] 26. The power controller of claim 24 wherein said control module comprises a transient voltage protection module adapted to limit said line voltage supply to a specified safe voltage level.

[C027] 27. The power controller of claim 24 wherein said control module comprises at least one electrical switch adapted to make or break electrical contact with said line voltage supply in response to said user interface signal.

[C028] 28. The power controller of claim 24 wherein said control module comprises at least one line voltage supply connector adapted to electrically couple said line voltage supply.

[C029] 29. The power controller of claim 24 wherein said control module comprises at least one load connector adapted to electrically couple said cooking element.

[C030] 30. The power controller of claim 24 wherein said control module comprises:

exactly one load connector adapted to electrically couple said cooking element; and

exactly two line voltage supply connectors adapted to electrically couple said line voltage supply.

[C031] 31. The power controller of claim 24 wherein said control module comprises:

exactly one load connector adapted to electrically couple said cooking element;

exactly one line voltage supply connector adapted to electrically couple said line voltage supply;

a transformer having a primary winding electrically coupled in series with said line voltage supply and said cooking element; and

a dual input power supply adapted to electrically couple said line voltage supply, electrically couple a secondary winding of said transformer, and provide signal-level operating power to said power controller.

[C032] 32. The power controller of claim 24 wherein said control module comprises:

a threshold-crossing detector adapted to generate a threshold-crossing signal whenever an output voltage of said line voltage supply crosses a specified voltage threshold;

a control processor adapted to receive said at least one user interface signal and said threshold-crossing signal and generate a switch command signal by implementing said low-flicker, cycle-skipping control algorithm; and

a power module adapted to receive said switch command signal and provide electrical power to said cooking element.

[C033] 33. The power controller of claim 32 wherein said control processor further comprises:

a signal decoder adapted to receive said user interface signal and generate a power command;

a command compensator adapted to receive said power command and generate a power reference signal; and

a switch command generator adapted to receive said power reference signal and said threshold-crossing signal and generate said switch command signal by implementing said low-flicker, cycle-skipping control algorithm.

[C034] 34. The power controller of claim 33 wherein said command compensator comprises a dynamic compensator.

[C035] 35. The power controller of claim 32 wherein said power module further comprises:

a switch driver adapted to receive said switch command signal and generate a gate signal; and

a controllable switch electrically coupled to said line voltage supply and said cooking element and adapted to provide electrical power to said cooking element as a function of said gate signal.

[C036] 36. The power controller of claim 35 wherein said controllable switch comprises a triac.

[C037] 37. The power controller of claim 35 wherein said power module further comprises a snubber electrically coupled to said controllable switch.

[C038] 38. The power controller of claim 35 wherein said power module further comprises a heat sink thermally coupled to said controllable switch.

[C039] 39. The power controller of claim 38 wherein said power module further comprises a fan adapted to provide an airflow over said heat sink.

[C040] 40. An electric cooking apparatus comprising:

a cooking element;

a user interface adapted to interact with a user to produce at least one user interface signal; and

a control module adapted to electrically couple a line voltage supply, electrically couple said cooking element, and provide electrical power to said cooking element as a function of said at least one user interface signal by implementing a fine resolution control algorithm, said control algorithm comprising a plurality of cycle patterns, said cycle patterns comprising a plurality of substantially equally spaced main power levels, each of said power levels having no net DC component.

[C041] 41. The electric cooking apparatus of claim 40 further comprising an auxiliary interface adapted to interact with at least one auxiliary sensor to provide at least one auxiliary interface signal to said control module.

[C042] 42. The electric cooking apparatus of claim 40 wherein said user interface comprises:

a control knob;

an input shaft adapted to mechanically couple said control knob and provide a mechanical signal; and

a shaft encoder adapted to generate said user interface signal in response to said mechanical signal.

[C043] 43. The electric cooking apparatus of claim 40 wherein said user interface comprises:

a touch panel adapted to interact with said user and provide at least one touch signal; and

a communications interface adapted to receive said at least one touch signal and generate said at least one user interface signal.

[C044] 44. The electric cooking apparatus of claim 40 wherein said control module comprises:

a threshold-crossing detector adapted to generate a threshold-crossing signal whenever an output voltage of said line voltage supply crosses a specified voltage threshold;

a control processor adapted to receive said at least one user interface signal and said threshold-crossing signal and generate a switch command signal by implementing said fine resolution control algorithm; and

a power module adapted to receive said switch command signal and provide electrical power to said cooking element.

[C045] 45. The electric cooking apparatus of claim 44 wherein said power module comprises a triac.

[C046] 46. The electric cooking apparatus of claim 40 wherein said control module comprises:

a transformer having a primary winding electrically coupled in series with said line voltage supply and said cooking element; and

a dual input power supply adapted to electrically couple said line voltage supply, electrically couple a secondary winding of said transformer, and provide signal-level operating power to said electric cooking apparatus.

[C047] 47. An electric cooking apparatus comprising:

a cooking element;

a control knob;

an input shaft adapted to mechanically couple said control knob and provide a mechanical signal;

a shaft encoder adapted to generate a user interface signal in response to said mechanical signal;

a power supply adapted to electrically couple a line voltage supply and provide signal-level operating power to said electric cooking apparatus;

at least one electrical switch adapted to make or break electrical contact with said line voltage supply in response to said mechanical signal;

at least one line voltage supply connector adapted to electrically couple said line voltage supply;

at least one load connector adapted to electrically couple said cooking element;

a threshold-crossing detector adapted to generate a threshold-crossing signal whenever said output voltage of said line voltage supply crosses a specified voltage threshold;

a signal decoder adapted to receive said user interface signal and generate a power command;

a command compensator adapted to receive said power command and generate a power reference signal;

a switch driver adapted to receive a switch command signal and generate a gate signal;

a controllable switch electrically coupled to said line voltage supply and said cooking element and adapted to provide electrical power to said cooking element as a function of said gate signal;

a switch command generator adapted to receive said power reference signal and said threshold-crossing signal and generate said switch command signal by implementing a low-flicker, cycle-skipping control algorithm, said control algorithm comprising a plurality of cycle patterns, said cycle patterns comprising substantially equally spaced main power levels, and each of said cycle patterns having no net DC component.

[C048] 48. The apparatus of claim 47 wherein said low-flicker, cycle-skipping control algorithm comprises a fine resolution control algorithm.

[C049] 49. The apparatus of claim 47 wherein said controllable switch comprises a triac.

[C050] 50. The apparatus of claim 47 comprising:

exactly one load connector adapted to electrically couple said cooking element; and

exactly two line voltage supply connectors adapted to electrically couple said line voltage supply.

[C051] 51. The apparatus of claim 47 comprising:

exactly one load connector adapted to electrically couple said cooking element;

exactly one line voltage supply connector adapted to electrically couple said line voltage supply; further comprising

a transformer having a primary winding electrically coupled in series with said line voltage supply and said cooking element; and wherein

said power supply comprises a dual input power supply adapted to electrically couple said line voltage supply, electrically couple a secondary winding of said transformer, and provide signal-level operating power to said electric cooking apparatus.